इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 11760 (1986): Gravity-fed kerosene wick stove [MED 26: Oil Burning Appliances]

"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

BLANK PAGE

BRUTUM FULMEN
IGNORANTIA JURIS NON EXCUSAT
PROTECTED BY COPYRIGHT

IS : 11760 - 1986
(Reaffirmed 2001)

Indian Standard

SPECIFICATION FOR GRAVITY-FED KEROSENE WICK STOVE

UDC 683·944 : 683·867

© *Copyright* 1987

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 5

March 1987

Indian Standard

SPECIFICATION FOR GRAVITY-FED KEROSENE WICK STOVE

Oil Burning Appliances (Non-Pressure Type) Sectional Committee, CPDC 2

Chairman	*Representing*
SHRI P. N. BHAMBI	Indian Institute of Petroleum (CSIR), Dehra Dun
Members	
SHRI K. S. KAMBO (*Alternate* to Shri P. N Bhambi)	
LT-COL DIPAK ANAND	Ministry of Defence (DGI)
LT-COL D. K. BHARGAVA (*Alternate*)	
SHRI BHARAT BAID	Hulasi Metal Industries, Jaipur
SHRI HARKISHOR V. BARCHHA	Ashok Iron and Steel Fabricators, Rajkot
SHRI VINODRAI V. BARCHHA (*Alternate*)	
SHRI A. GHOSH	National Test House, Calcutta
SHRI D. K. RAY (*Alternate*)	
SHRI H. P. GUPTA	Modi Lantern Works, New Delhi
SHRI M. K. JAIN	Jainsons Containers Manufacturing Works, Meerut
SHRI KRANTI KUMAR JAIN (*Alternate*)	
SHRI KRISHAN LAL GROVER	D. K. Traders, Delhi
SHRI K. C. VERMA (*Alternate*)	
SHRI J. K. KARNANI	Prabhat Udyog Ltd, Bombay
SHRI S. CHATURVEDI (*Alternate*)	
SHRI RAMESH P. KHANNA	Niky Tasha India Pvt Ltd, Faridabad
SHRI B. S. MANUJA (*Alternate*)	
SHRI R. K. MALIK	National Small Industries Corporation Limited, New Delhi
THE MANAGING DIRECTOR	Ogale Glass Works Ltd, Satara
SHRI M. S. OGALE (*Alternate*)	
SHRI A. K. MEHTA	Indian Oil Corporation Ltd, Bombay
SHRI S. P. DUBEY (*Alternate*)	
SHRI R. C. MISRA	Consumer Guidance Society of India, Bombay
SHRIMATI KRISHNA BASRUR (*Alternate*)	
SHRI B. C. MITTAL	Balmer Lawrie & Co Ltd, Mathura
SHRI S. SHRINATH RAO	Ministry of Energy (Department of Petroleum)
SHRI H. C. SAWHNEY	Crown Manufacturing House, Delhi

(*Continued on page* 2)

© *Copyright* 1987
INDIAN STANDARDS INSTITUTION
This publication is protected under the *Indian Copyright Act* (XIV of 1957) and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

(*Continued from page* 1)

Members	*Representing*
SHRI T. R. SEHGAL	Office of the Development Commissioner, Small Scale Industries, New Delhi
SHRI M. B. SINGH	Ministry of Defence (R & D)
SHRI V. K. SABHARWAL (*Alternate*)	
SHRI T. N UBOVEJA	Directorate General of Supplies and Disposals (Inspection Wing), New Delhi
DR A. S. SETHI, Director (Consr Prods & Med Instrs)	Director General, ISI (*Ex-officio Member*)

Secretary

SHRI B. RAMAKRISHNA RAO
Assistant Director (Consr Prods & Med Instrs), ISI

Indian Standard

SPECIFICATION FOR GRAVITY-FED KEROSENE WICK STOVE

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 24 June 1986, after the draft finalized by the Oil Burning Appliances (Non Pressure Type) Sectional Committee had been approved by the Consumer Products and Medical Instruments Division Council.

0.2 Kerosene and LPG being two competitive petroleum-based domestic fuels used in supplementary way, there is scope to provide better types of kerosene stoves with greater consumer choice. In the gravity-fed wick stove there is flow of kerosene to the wick due to the marginal gravity head of kerosene placed in an offset container.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2 - 1960*. The number of significant places retained in the rounded off value should be the same as that of the specified values in this standard.

1. SCOPE

1.1 This standard specifies the construction, operation and safety requirements and tests for gravity-fed kerosene wick stove.

2. TERMINOLOGY

2.1 For the purpose of this standard, the nomenclature of the different parts of the stove shall be as indicated in Fig. 1 and defined below.

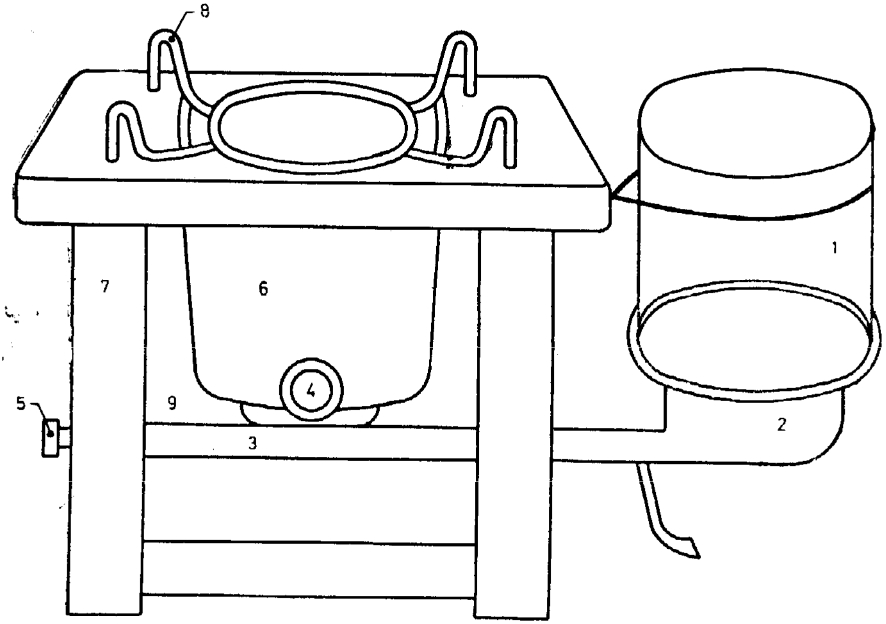
Note — Gravity-fed wick stoves may be of any design. Typical gravity-fed stove is shown in Fig. 1.

2.1.1 *Gravity-fed Wick* — A non-pressure stove in which the fuel reaches the burner by means of gravity head.

2.1.2 *Kindler* — A thick cotton or asbestos fabric covered with removable wire-gauge or interwoven with metallic fibre used for lighting wicks. A typical kindler is shown in Fig. 2.

---

*Rules for rounding off numerical values (*revised*).



1. Fuel container
2. Fuel bowl
3. Fuel feed tube
4. Fuel regulating valve
5. Nut
6. Burner cover with inner and outer perforated sleeves
7. Stove frame
8. Pan support
9. Trough

FIG. 1 GRAVITY-FED KEROSENE WICK STOVE TYPICAL

2.1.3 *Flame Extinguisher* — A mechanism preferably a metallic ring suitable to cover the wick top without damaging the wick to extinguish the flame of the burner. A typical flame extinguisher is shown in Fig. 3.

2.1.4 *Thermal Efficiency* — Thermal efficiency of a stove may be defined as the ratio of heat available for actual utilization to the heat theoretically produced by complete combustion of a given quantity of fuel (which is based on net calorific value of the fuel).

3. CONSTRUCTION AND MATERIAL

3.1 General

a) The construction and strength of materials used shall be such that no harmful distortion of any part of the stove takes places under normal conditions of use and that the durability and safety are ensured.

b) The stove shall be so designed as to be capable of being levelled for uniform flow of kerosene from the container to the bowl.

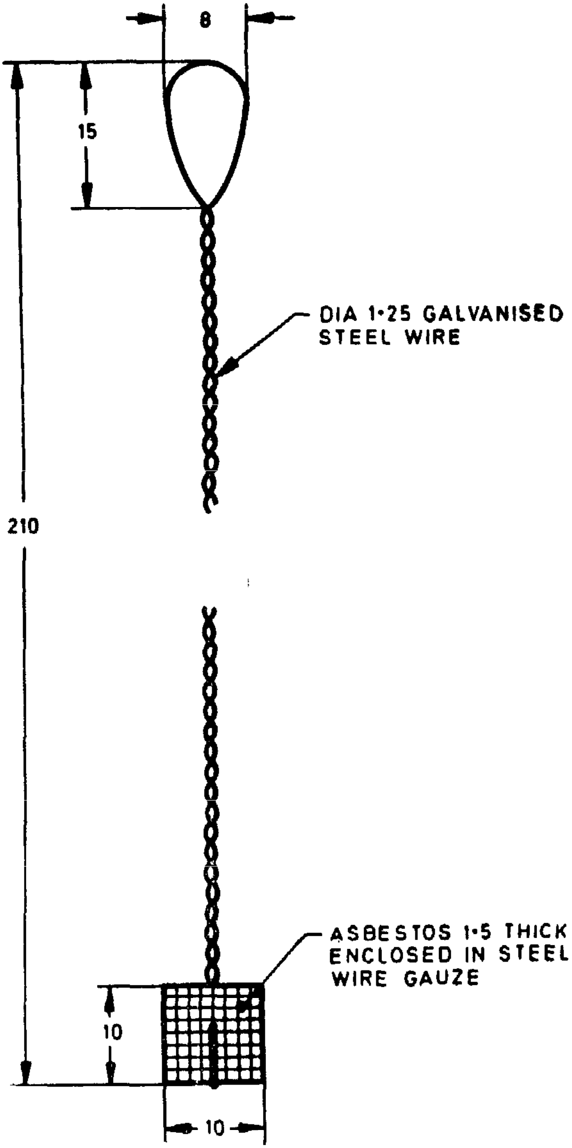
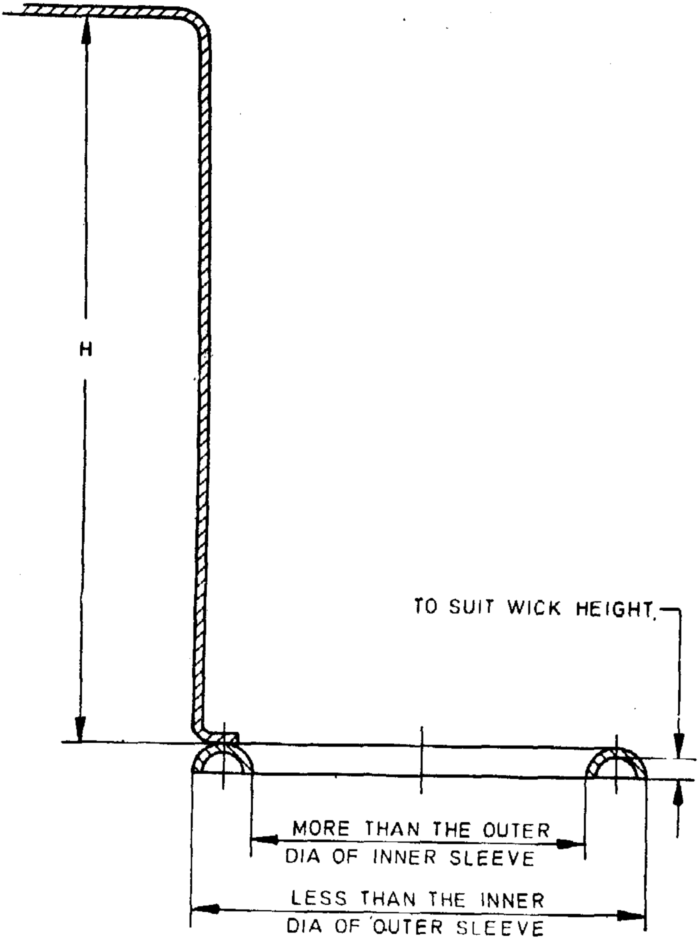

8
15
210
DIA 1·25 GALVANISED STEEL WIRE
ASBESTOS 1·5 THICK ENCLOSED IN STEEL WIRE GAUZE
10
10

FIG. 2 KINDLER


H
TO SUIT WICK HEIGHT
MORE THAN THE OUTER DIA OF INNER SLEEVE
LESS THAN THE INNER DIA OF OUTER SLEEVE

H = More than the height of the perforated sleeves.

FIG. 3 FLAME EXTINGUISHER

c) The exterior surfaces shall be painted with corrosion-resistant paint or electroplated.

d) The stove may be made in single burner or multiple burner design.

3.2 Perforated Sleeves — The inner and outer perforated sleeves shall be made from the steel sheets as specified in IS : 513 - 1973*. They are also

---

*Specification for cold rolled carbon steel sheets (*second revision*).

made from stainless steel sheets as specified in IS : 6911 - 1972*. The thickness of the sheet shall be such that the finished thickness of the perforated sleeves at any place shall not be less than 0·35 mm. The outer cover of the sleeves shall be made from the similar sheet. A suitable corrosion resistant protective coating may be provided on burner sleeves to avoid corrosion before putting it to use for the first time.

3.3 Fuel Bowl — The fuel bowl shall be made from mild steel, brass or stainless steel sheet of 0·40 mm thickness and shall have such dimensions suitable for fitting placement of inverted fuel tank over it. The fuel bowl shall be connected to the feed tube in the bottom of the bowl at such alignment so as to ensure proper flow of kerosene.

3.4 Fuel Container — A glass, mild steel, brass or stainless steel tank of suitable capacity shall be used as fuel container. The fuel tank shall have a special lid with a spring loaded opening or such other device, such that it opens in the fuel bowl when placed inverted over it. The mouth of the fuel container shall just did in kerosene in the bowl. The design of the fuel container and fuel bowl should be such as to avoid any tilting of the container during use.

3.4.1 Fuel container made from steel sheets shall be conforming to IS : 513 - 1973†. If made from brass it shall be conforming to IS : 410 - 1977‡. If made from stainless steel it shall be conforming to IS : 6911 - 1972§.

The thickness of all the metallic sheets used shall be such that the finished thickness of fuel container at any place shall be not less than 0·40 mm.

3.4.2 In case of the glass container the finished thickness shall be not less than 4·0 mm at any place. The glass container shall be provided with a suitable protective guard. A typical guard is shown in Fig. 4.

3.4.3 In case of metallic container an oil level indicator shall be provided.

3.5 Wick — A single flat type wick made of materials, such as asbestos fibre shall be used. The construction of the wick shall be such that it shall not break during usuage or maintenance. The length of the wick shall be such that its ends just meet together when placed in the round wick trough.

---

*Specification for stainless steel plate sheet and strip.

†Specification for cold rolled carbon steel sheets (*second revision*).

‡Specification for cold rolled brass sheet, strip and foil (*third revision*).

§Specification for stainless steel plate sheet and strip.

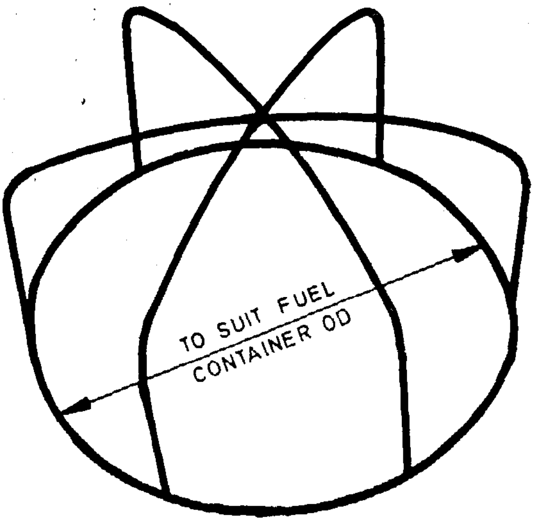


FIG. 4 PROTECTIVE GUARD FOR GLASS FUEL CONTAINER

3.6 Fuel Feed Tube and Regulating Valve — The fuel feed tube may be made out of electric resistance welding (ERW) tube with minimum thickness of 1 mm and shall have an appropriate regulating valve for control of fuel flow to the wick.

3.7 Pan Support — The design of the pan support be such that usually the vessel should rest in stable condition.

4. GENERAL REQUIREMENTS

4.1 The construction of the stove shall be sturdy so that while in actual use on level floor, it cannot get shaky or field at any point. When two or more burners are provided on the stoves, the centre-to-centre distance shall be not less than 350 mm. The stove shall be so designed that the spillage shall not be excessive to cause fire hazards, when it is overturned. The construction of the stove shall be such that the temperature of the fuel when measured in accordance with **5.6** shall not rise beyond 60°C during operation.

4.2 The capacity of the fuel container shall be such that the stove can be continuously operated at full output for at least 6 hours in one filling without interruption when all the burners are in operation.

4.3 The fuel shall not leak at any point of the fuel tank and fuel regulating valve. All the joints such as fuel bowl and fuel feed tube; regulating valve and fuel feed tube, fuel feed tube and wick trough, etc, shall be welded or brazed to give an airtight and fuel tight joint. The joints shall be tested at an air pressure of 20 kN/m^2 (0·2 kgf/cm^2) to ensure fuel tightness.

4.4 The perforated sleeves shall sit properly and stay in position while in normal use.

4.5 Resistance to Corrosion — The fuel container and fuel bowl when made from mild steel shall be resistant to corrosion. When made from mild steel they shall be adequately coated internally with a suitable petrol-resisting paint coating to render it resistant to corrosion from accumulated water droplets. The paint, when air drying, shall conform to IS : 144 - 1950* or IS : 145 - 1950†. When stoving paint is employed, it shall conform to IS : 146 - 1950‡ or IS : 147 - 1950§.

4.5.1 Alternatively, the internal surface of the fuel container and bowl if made from metallic sheets, may be provided with an electroplated zinc coating of minimum 0·005 mm thickness in accordance with IS : 1573 - 1970‖ to render it corrosion resistant.

4.5.2 The internal surface of fuel container and fuel bowl made from mild steel can also be made corrosion-resistant by phosphating which shall conform to IS : 3618-1966¶.

5. PERFORMANCE TESTS

5.1 Test conditions for carrying out all performance tests shall be in accordance with Appendix A.

5.2 Thermal Efficiency Test — Thermal efficiency for each burner, when tested in accordance with the method described in Appendix B, shall be not less than 60 percent.

5.3 Combustion Efficiency Test — When tested, in accordance with the details laid down in Appendix C, the volumetric ratio of carbon monoxide to carbondioxide in the exhaust gases of each burner, while burning with maximum blue flame, shall not exceed 0·02.

---

*Specification for ready mixed paint, brushing, petrol resisting, air drying, for interior painting of tanks and containers, red oxide (colour unspecified).

†Specification for ready mixed paint, slushing, petrol resisting, air drying for interior painting of tanks and containers, red oxide (colour unspecified).

‡Specification for ready mixed paint, brushing, petrol resisting, stoving, for interior painting of tanks and containers, red oxide (colour unspecified).

§Specification for ready mixed paint, slushing petrol resisting, stoving for interior painting of tanks and containers, red oxide (colour unspecified).

‖Specification for electroplated coatings for zinc on iron and steel (*first revision*).

¶Specification for phosphate treatment of iron and steel for protection against corrosion.

5.4 Flame Stability Test — To perform this test, the fuel container shall be filled to three-fourth of its full capacity and the burner shall be lit. The flame shall be adjusted as soon as possible to the full flame size and may be readjusted, if necessary, during the first 15 minutes after lighting up. After that no adjustment shall be made to the flame during the test.

5.4.1 In the above described position the flame shall be observed for one hour when the vessel containing water is put on the stove. During this period the flame shall not flicker or shall not cause an increase in flame size or the emission of visible smoke.

5.5 Fuel Creep — There shall be no spreading of fuel over any external part of the appliance during a period of 4 h following its final adjustment, when operated at the manufacturer's stated maximum blue flame setting and fuel container filled to 3/4th of its capacity.

5.6 Surface Temperature Tests — The surface temperature of any part of the stove that may be necessary to touch during its operation shall not exceed 60°C when measured in accordance with the procedure given in Appendix D.

5.7 Fuel Temperature Test — The appliance with its fuel container filled with fuel to nearly three-fourth of its capacity shall be run for two hours, with a vessel containing water kept on the stove, at maximum blue flame setting. The maximum temperature of the fuel in the fuel container shall be measured. It shall not exceed 60°C.

5.8 Stability Test — Stove, both when full of fuel and when empty, shall be capable of being tilted in any direction to an angle of 15° from the vertical, without overturning on being released.

5.9 Ability to Withstand Heavy Loads — The top plate of the stove or vessel supports whichever the case may be, shall be so designed as to be adequately strong to withstand the load calculated in accordance with following :

For circular top plate	Diameter in centimetre of top plate expressed in kilogram
For square frame	Side of the square in centimetre expressed in kilogram

5.9.1 The load as calculated above shall be applied uniformly distributed for a period of one hour. At the end of the test, there shall not be any deformation or permanent set of any component of the stove.

6. CATEGORIES OF TESTS

6.1 The tests are classified into three categories, namely, type tests, acceptance tests and routine tests according to Table 1.

TABLE 1 CATEGORIES OF TESTS
(*Clause* 6.1)

SL No.	TEST	CLAUSE REFERENCE
i)	Type tests	5.3 and 5.9
ii)	Acceptance tests	5.2, 5.4. 5.5, 5.6, 5.7, and 5.8
iii)	Routine tests	4.1 and 4.2

7. INSTRUCTIONS

7.1 Instructions giving complete information about the safe operation, filling and maintenance of the non-pressure stove shall be supplied with the stove and should be printed in English and Hindi. These shall be supplied in the form of a durable booklet and shall include the following:

a) Prior to lighting the stove, ensure that all the components are undamaged and properly assembled in accordance with the design.

b) Place the stove on a perfect level to ensure uniform flow of kerosene in the wick-trough. The level can be checked by placing a pan of water on the stove.

c) Fill the kerosene oil in the container to its three-fourth capacity and place it inverted on the fuel bowl.

d) That the stove shall use kerosene only and the use of fuels other than kerosene is dangerous.

e) The maximum quantity or level of kerosene to be filled in the container for normal use.

f) Open the fuel regulator and light the soaked wick with a kindler to obtain a uniformally spread blue and stable flame. To extinguish the flame, close the regulator and put on the flame extinguisher. Do not blow off the flame.

g) That it is dangerous to pour kerosene in the fuel container while the stove is burning and any short cut or direct method of pouring kerosene into the fuel container shall be avoided.

h) Occasionally clean the perforated sleeves and flush out the fuel feed tube free of any sediment and dirt for good performance of the stove.

j) Any special instruction for the safe and efficient use/operation of the stove shall be included.

7.1.1 The manufacturer shall indicate the useful heat output of the stove and other useful information relating to the stove.

8. MARKING

8.1 The name or trade-mark of the manufacturer and the country of origin shall be legibly and indelibly marked at a prominent place on the stove and also on the carton box in which the stove is packed.

8.1.1 The stove may also be marked with ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. Presence of this mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection testing and quality control during production. This system, which is devised and supervised by ISI and operated by the producer has the further safeguard that the products as actually marketed are continuously checked by ISI for conformity to the standard. Details of conditions, under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

9. PACKING

9.1 Packing shall be done according to best trade practices, or as agreed to between the purchaser and the supplier.

10. SAMPLING

10.1 Sampling and acceptance criteria for gravity-fed-kerosene wick stoves shall be as agreed to between the purchaser and the supplier. A recommended scheme for the same is given in Appendix. E.

APPENDIX A

(*Clause* 5.1)

CONDITIONS FOR CARRYING OUT THE PERFORMANCE TESTS

A-1. TEST ROOM CONDITIONS

A-1.1 The test room shall be ventilated such that there are no air draughts that are likely to affect the performance of the stove. The room temperature shall be maintained between 20° — 30°C.

A-1.2 The stove and kerosene in its container shall be at room temperature at the start of the tests.

A-2. TEST KEROSENE

A-2.1 The kerosene to be used in conducting the performance tests shall confirm to IS : 1459-1974*.

A-3. STOVE SETTING

A-3.1 Prior to the performance tests the stove shall be checked and examined to ensure that all components are undamaged and are properly assembled and levelled as per manufacturer's instructions. The setting and operation of the stove shall be done as per following procedure:

a) The stove shall be placed in perfect level so as to ensure uniform spread of kerosene all through the wick-trough.

b) The single flat wick shall be placed in the trough such that its ends just meet together in front of the burner.

c) The fuel valve shall be opened and wick shall be allowed to be adequately socked in kerosene before lighting. Fix the sleeves and light the stove with the help of the kindler. Allow the stove to burn for a period of 10 minutes during which the fuel should be adjusted with the help of fuel regulating valve so as to get stable and maximum blue flame conditions. Put the vessel and readjust the fuel regulating valve to get a maximum blue flame.

APPENDIX B

(*Clause* 5.2)

TEST FOR THERMAL EFFICIENCY

B-1. FUEL CONSUMPTION TEST

B-1.1 The stove whose efficiency is to be determined shall be filled with kerosene up to three-fourth of its capacity. Allow the stove to burn for 10 minutes during which it should be adjusted to attain its maximum blue flame height. Place a 2 mm thick flat steel plate, covering the flame of the lighted stove and the lighted stove shall be weighed on a sensitive dial balance with an accuracy of 1 g. The stove shall be allowed to burn for one hour with an aluminium vessel having sufficient water in it. The stove shall be weighed again after removing the vessel and with the flame covered by the same flat steel plate of 2 mm thick. The difference in initial and final weight of the burning stove shall give the fuel comsumption rate in g/h.

A suitable vessel size and quantity of water to be taken for determining the thermal efficiency shall be selected from Table 2 depending upon the fuel consumption rate.

---

*Specification for kerosenes (*second revision*).

TABLE 2 ALUMINIUM VESSELS FOR THERMAL EFFICIENCY TEST

FUEL CONSUMPTION RATE g/hr (1)	VESSEL DIAMETER (EXTERNAL) ± 5 mm (2)	VESSEL HEIGHT (EXTERNAL) ± 5 mm (3)	TOTAL VESSEL WEIGHT WITH LID g(± 10 PERCENT) (4)	WEIGHT OF WATER IN VESSEL, kg (5)
Up to 100	180	100	356	2·0
101 to 130	205	110	451	2·8
131 to 150	220	120	519	3·7
151 to 180	245	130	632	4·8
181 to 200	260	140	750	6·1
201 to 240	285	155	853	7·7
241 to 270	295	165	920	9·4
271 to 300	320	175	1 100	11·4

B-1.2 The test is conducted by heating water in flat bottommed aluminium vessels (size of the vessel and quantity of water to be taken are selected from Table 2 depending upon the fuel consumption rate) and provided with aluminium lid having two suitable holes, one for inserting a cork for holding thermometer and other for stirrer of aluminium wire required for stirring the water. The vessel bottom from inside shall have bright finish. The water in the vessel is heated from initial temperature of 25 ± 2°C to temperature below the boiling point of water. Thermal efficiency is then calculated by dividing the heat absorbed by the vessel and water to heat supplied by the kerosene consumption.

B-1.3 Trim the wicks uniformly as per directions of the manufacturer, if provided. Again check the kerosene level in the fuel tank which should be approximately three-fourth of the tank capacity. Take two aluminium vessels and fill them with water (size of the vessel and the quantity of water to be taken are selected from Table 2 depending upon the fuel consumption rate) at a temperature of 25 ± 2°C which has been achieved by adding ice or cold water/hot water or tap water. Fit the stirrer and thermometer on the vessel lid. Light the stove and adjust the wicks till it gives blue flame at maximum flame height. Operate the stove for 10 minutes under maximum blue flame conditions.

B-1.4 Note the weight of the lighted stove with the flame covered by a 2 mm thick flat steel plate and start a stop watch at the time of recording initial weight of the burning stove. Put the vessel on the stove and start immediately second stop watch. Heat the water while stirring with the help of stirrer till it attains the temperature of 5°C below the boiling point. Note the time required to heat the water from initial temperature (25 ± 2°C) to the final temperature, that is (5°C below B. P.), in the second case. Leave the vessel on the stove and let it burn for one hour. At the end of one hour, remove the vessel and note the weight of the lighted stove with the flame covered with the same flat steel plate of 2 mm thick. The difference in the initial and the final weight of the burning stove shall give the kerosene consumption rate in g/h. Thermal efficiency shall be calculated for two different vessels. If the individual thermal efficiency values differs by more than 4 percent the complete tests shall be repeated.

NOTE — Care should be taken that water is stirred gently during heating.

B-1.5 In case an hourly fuel consumption obtained during test as per **B-1.4** falls, above the highest or below the lowest limit of the range of kerosene consumption rate on the basis of which the vessel was selected earlier, then the test should be repeated with a vessel based upon fuel consumption obtained during test as in **B-1.4**. The average of thermal efficiency calculated as in **B-1.4** and **B-1.5** would give thermal efficiency of the stove.

B-2. CALCULATION

B-2.1 (In SI Units)

Let

w = mass of water in the vessel in kg,

W = mass of vessel complete with lid and stirrer in kg,

t_1 = initial temperature of water in °C,

t_2 = final temperature of water in °C,

X = mass of fuel consumed per hour in kg, and

T = time in minutes taken to heat water from t_1 to t_2.

(specific heat of aluminium = 0·896 kJ/kg°C. Calorific value of fuel = 43 960 kJ/kg).

Then

Heat taken by the vessel $= W \times 0{\cdot}896\,(t_2 - t_1)$ kJ

Heat utilized for heating water $= w \times 4{\cdot}186\,8\,(t_2 - t_1)$ kJ

Total heat utilized $= (W \times 0{\cdot}896 + w \times 4{\cdot}186\,8)(t_2 - t_1)$ kJ

$$\text{Heat produced by fuel} = \frac{X \times T}{60} \times 43\,960 \text{ kJ}$$

$$\text{Thermal efficiency, percent} = \frac{\text{Heat utilized}}{\text{Heat produced}} \times 100$$

$$= \frac{(W \times 0{\cdot}896 + w \times 4{\cdot}186\,8)(t_2 - t_1)}{X \times T \times 43\,960} \times 60 \times 100$$

B-2.2 (In Metric Units)

Let

w = mass of water in the vessel in kg,
W = mass of vessel complete with lid and stirrer in kg,
t_1 = initial temperature of water in °C,
t_2 = final temperature of water in °C,
X = mass of fuel consumed per hour in kg, and
T = time in minutes taken to heat water from t_1 to t_2.

(specific heat of aluminium = 0·214 kcal/kg°C. Calorific value of fuel = 10 500 kcal/kg).

Then

Heat taken by the vessel $= W \times 0{\cdot}214\ (t_2 - t_1)$ kcal
Heat utilized for heating water $= w \times 1\ (t_2 - t_1)$ kcal
Total heat utilized $= (W \times 0{\cdot}214 + w) (t_2 - t_1)$ kcal

$$\text{Heat produced by fuel} = \frac{X \times T}{60} \times 10\,500 \text{ kcal}$$

$$\text{Thermal efficiency, percent} = \frac{\text{Heat utilized}}{\text{Heat produced}} \times 100$$

$$= \frac{(W \times 0{\cdot}214 + w) (t_2 - t_1)}{X \times T \times 10\,500} \times 60 \times 100$$

NOTE — 1 kcal = 4·186 8 kJ.

APPENDIX C

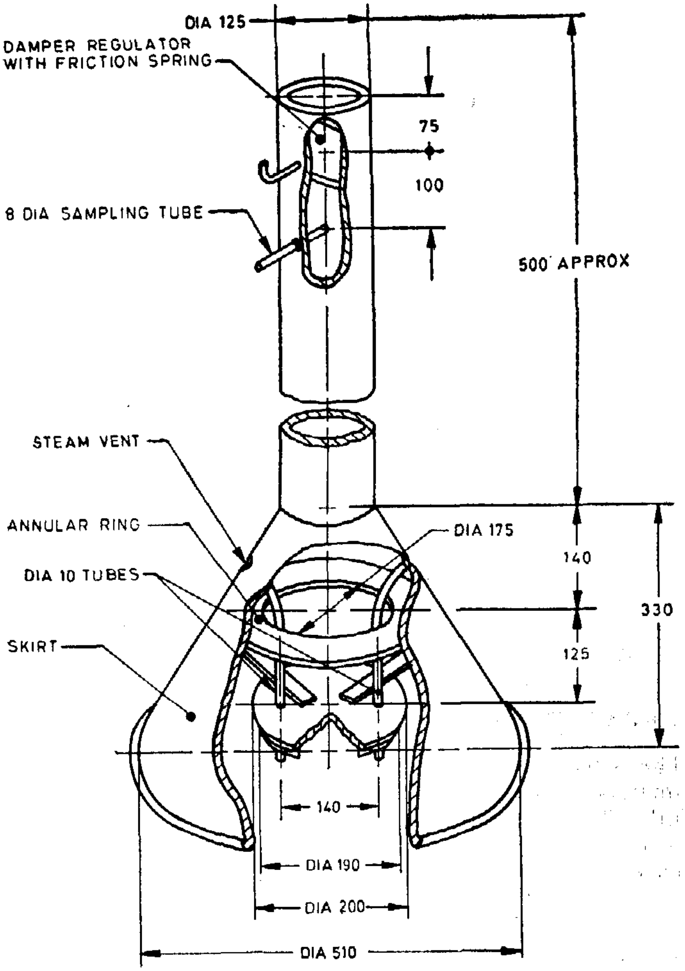
(*Clause* 5.3)

TEST FOR COMBUTION EFFICIENCY

C-1. EQUIPMENT

C-1.1 The stove shall be tested with its fuel container filled with kerosene to nearly three-fourths of its capacity. Before starting the test, a vessel of suitable diameter and height and containing water sufficient for the test shall be placed over the burner. In addition, a collecting hood (Fig. 5), suitable for stove under examination shall be used.

C-1.1.1 The hood shall be so designed that, while not interfering in any way with the normal combustion of the burner, it collects a fairly high proportion of the flue gases. Also it shall be such that the sample collected represents the whole of combustion gases and not those from



All dimensions in millimetres.

FIG. 5 HOOD FOR BURNERS

one particular point. When using hood, the damper provided shall be set or additional flue pipe added, so that spillage of the flue gases around the skirt is minimized.

C-2. PROCEDURE

C-2.1 With the hood in position over the stove under investigation, the stove shall be fit and run at full output for a few minutes till a stable flame is achieved. Then a sufficient number of samples shall be collected.

C-2.2 Any of the recognized methods may be used for gas analysis. For carbon monoxide, it is recommended that co indicator of prescribed accuracy or the iodine pentoxide method or catalytic method, for example, the Drager method, Katz method, or infra-red analysis may be used. Carbon dioxide may be tested with Orsat apparatus, Haldane apparatus or by the infra-red analysis.

C-2.3 Each burner shall be tested separately. The carbon monoxide and carbon dioxide contents of the product of combustion shall be determined by the methods capable of an accuracy of 0·001 and 0·05 percent, respectively, of the volume of the sample.

APPENDIX D

(*Clause* 5.6)

METHOD OF MEASUREMENT OF SURFACE TEMPERATURE

D-1. PREPARATION OF STOVE

D-1.1 The stove shall be tested with the fuel container containing approximately 75 percent of the amount of fuel, which it would hold when full. The stove shall be lit and run at the full output for one hour before starting the measurement of temperature, with the pan containing water placed over it. In case of two or more burners stove, all the burners shall be lit simultaneously during the test.

D-2. PROCEDURE

D-2.1 The temperature of all parts of the stove which may be necessary to touch during its operation shall be measured by using a thermometer or any other suitable device for measuring the surface temperature. The temperature of each such part shall be measured thrice every 50 minutes until equilibrium is reached. While measuring the temperature, the thermometer shall be covered with a felt pad and kept in contact with that part for sufficient period of time until the maximum temperature is reached.

APPENDIX E

(*Clause* 10.1)

SAMPLING AND CRITERIA FOR CONFORMITY

E-1. LOT

E-1.1 In a consignment of gravity-fed wick stoves of the same construction and type (single or multiple burner) shall be grouped together to constitute a lot not exceeding 500 stoves.

E-2. SCALE OF SAMPLING

E-2.1 Each lot shall be inspected for judging the conformity to the requirements of the specification.

TABLE 3 SCALE OF SAMPLING

LOT SIZE (1)	SAMPLE SIZE (FOR VISUAL EXAMINATION) (2)	ACCEPTANCE NUMBER (3)
Up to 50	8	0
51 to 100	13	0
101 to 300	20	1
301 to 500	32	2

E-2.2 From each lot, the required number of stoves given in col 2 of Table 3 shall be selected at random by using random number tables (*see* IS : 4905-1968*). These sample stoves shall be unpacked and examined for instruction sheets and construction details as given in **3**. Any stove which fails to meet one or more of the requirements of the above clause shall be termed defective. The number of defective stoves in the sample shall not exceed the acceptance number given in col 3 of Table 3, if the lot is to be accepted under this clause.

E-3. CRITERIA FOR PERFORMANCE REQUIREMENTS

E-3.1 If the lot is found satisfactory according to **E-2.2**, it shall then be tested for performance requirements given in **5**.

---

*Methods for random sampling.

E-3.2 One sample stove at the rate of every 100 or part thereof among the stoves in the lot shall be tested for all performance requirements except combustion efficiency (**5.3**) and surface temperature (**5.6**). These samples may be drawn from the samples already selected for examining construction details. For the purpose of combustion efficiency and surface temperature, one test for each lot shall be performed on the sample stoves already selected.

E-3.3 The lot shall be deemed conforming to the requirements of performance if all the samples selected under this clause pass the tests.